

SWORN TRANSLATION

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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[Title of the Invention]	Pneumatic tire having excellent bead portion durability
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[Identification of Document] Specification

[Title of the Invention] Pneumatic tire having excellent bead portion durability

[Claims]

[Claim 1] In a pneumatic tire having an excellent bead portion durability comprising at least one carcass ply containing steel cords therein and toroidally extending from a tread portion through sidewall portion to a bead portion, in which the carcass ply is wound around a bead core embedded in the respective bead portion from an inside of the tire toward an outside thereof in a radial direction to form a part or a whole of a wound portion of the carcass ply as a wind contact part along the peripheral face of the bead core, the improvement wherein at least one wire chafer is arranged in the bead portion.

[Claim 2] A pneumatic tire having an excellent bead portion durability according to claim 1, wherein a main body of the carcass ply is sandwiched between two wire chafers in a thickness direction thereof.

[Claim 3] A pneumatic tire having an excellent bead portion durability according to claim 1 or 2, wherein cords constituting one of the wire chafers are extended in a direction opposite to at least one of a cord extending direction of the other wire chafer and a cord extending direction of the carcass ply.

[Detailed explanation of the Invention]

[0001]

[Field of the Invention]

This invention relates to a pneumatic tire having an excellent bead portion durability, and more particularly to a heavy duty pneumatic radial tire for use in truck, bus and the like.

[0002]

[Prior Art]

In the conventional heavy duty pneumatic radial tire, it is general that as partly and sectionally shown in Fig. 5, at least one carcass ply c is toroidally extended between a pair of bead cores bc embedded in the respective bead portions b through a tread portion and sidewall portions and turned up around the bead core bc from an inside of the tire toward an outside thereof in a widthwise direction of the tire. In such a structure of the bead portion, when the tire is assembled onto a rim and run under loading, a part of the bead portion located outward from a rim flange

rf in a radial direction is repeatedly subjected to a deformation falling down outward in a widthwise direction of the tire, whereby stress concentration is caused in a turnup end of the carcass ply c and hence there is caused a problem that separation failure is apt to be caused at a turnup end of the carcass ply.

[0003]

In order to solve the separation failure at the turnup end, it is proposed that the side portion of the carcass ply is wound around the bead core and the end thereof is located to such a portion of the bead portion that strain is small as disclosed, for example, in JP-A-9-156310.

[0004]

[Problem to be solved by the invention]

According to the proposed technique, however, the turnup portion of the carcass as in the conventional technique is not existent, so that the resistance to fall-down deformation as previously mentioned becomes small, and hence the resistance of the bead portion to the fall-down deformation is decreased and fatigues in an outer surface part of the bead portion contacting with a vicinity of an outer peripheral edge of a rim flange and in a bead heel part contacting with a base part of the rim flange are particularly increased, and hence there is caused a problem that fatigue breakage from these parts can not be eliminated.

[0005]

It is, therefore, an object of the invention to advantageously solve the aforementioned problems and to provide a pneumatic tire having an excellent bead portion durability by preventing the occurrence of separation failure at the wound end of the carcass ply and effectively eliminating the fatigue breakage of the bead portion.

[0006]

[Means for solving problems]

According to the invention, there is the provision of in a pneumatic tire having an excellent bead portion durability in which at least one carcass ply containing steel cords extended at an angle of about 70-90° with respect to an equatorial plane of the tire is toroidally extended from a tread portion through a sidewall portion to a bead portion and wound around a bead core embedded in the bead portion from an inside of the tire toward an outside thereof in a radial direction

to form a part or a whole of a wound portion of the carcass ply as a wind contact part along the peripheral face of the bead core, the improvement wherein at least one wire chafer is arranged in the bead portion.

[0007]

The term "wire chafer" used herein means a bead portion reinforcing layer made of steel cords, and the arranging region thereof may be arranged either inside and outside the bead core in the widthwise direction of the tire including an inner peripheral side of the bead core.

[0008]

According to the above bead portion structure of the pneumatic tire, the occurrence of separation failure at the wound end of the carcass ply can be prevented by winding the side portion of the carcass ply around the bead core along the outer peripheral face thereof. And also, the given number of the wire chafers are arranged in the required region of the bead portion to enhance the lateral rigidity of the bead portion, whereby the outward fall-down deformation of the bead portion in the widthwise direction of the tire can effectively be controlled in the running of the tire under loading or the like to sufficiently prevent the occurrence of fatigue breakage of a part of the bead portion contacting with a rim flange or the like.

[0009]

In a preferable embodiment, a main body of the carcass ply is sandwiched between two wire chafers in a thickness direction thereof, or cords constituting one of the wire chafers are extended in a direction opposite to at least one of a cord extending direction of the other wire chafer and a cord extending direction of the carcass ply.

[0010]

When the main body of the carcass ply is sandwiched between the two or more wire chafers, the lateral rigidity of the bead portion can be more enhanced as compared with the case that one wire chafer is arranged along the inside or outside of the main body of the carcass ply in the widthwise direction of the tire, whereby the fear of causing the fatigue breakage of the bead portion can effectively be eliminated to largely improve the bead portion durability. This is particularly conspicuous in the latter case. When the cord extending directions are opposite between the wire chafers and/or between the wire chafer and the carcass ply, the

rigidity of the bead portion can be further increased.

[0011]

[Embodiments of the Invention]

An embodiment of the invention will be described with reference to the accompanying drawings.

Fig. 1 is a section view in a widthwise direction of the tire showing a bead portion of the embodiment of the invention.

Numeral 1 is a single carcass ply. The carcass ply 1 toroidally extends from a tread portion not shown through a sidewall portion not shown up to a bead portion 2 and contains steel cords arranged at an angle of about 70-90° with respect to an equatorial plane of the tire.

[0012]

Each side portion of the carcass ply 1 is wound around a bead core 3 embedded in the bead portion 2 from an inside of the tire toward an outside thereof in a radial direction to form a wind contact part 4 around a peripheral face of the bead core 3 along the wound portion.

In the illustrated embodiment, the wound portion is formed by winding from the inside toward the outside in the widthwise direction of the tire, but it is possible to wind from the outside toward the inside in the widthwise direction of the tire.

[0013]

In the formation of the wind contact part 4, it is favorable that at least one portion of the carcass ply corresponding to respective corner part of the bead core 3 is subjected to plastic deformation to thereby more exactly extend along the peripheral face of the bead core. As a result, the wind contact part 4 is effectively restrained by the bead core 3, whereby fears of getting out cords from the carcass ply and creating separation failure at the wind contact part can advantageously be eliminated.

[0014]

Prior to the winding of the carcass ply 1 around the bead core 3, the plastic deformed position is favorable to be previously formed in a portion of the carcass ply corresponding to the wind contact part 4, whereby the plastic deformation can always and exactly be carried out as is expected and hence the

above effect can be more enhanced.

[0015]

Then, the wind contact part 4 is interposed between the bead core 3 and a bead filler 5 located at an outer peripheral side thereof, whereby the wind contact part 4 can be more closed to the bead core 3 through the bead filler 5 to more advantageously prevent the get-out of the cords and the separation failure at the wind contact part 4.

[0016]

Preferably, the wind contact part 4 is extended along the peripheral face of the bead core 3 over a half periphery of a sectional profile of the bead core. Moreover, the bead core 3 usually has a sectional profile shape such as polygon, circle or the like. In any case, the above effect can be more enhanced by extending the wind contact part 4 along the peripheral face of the bead core 3 over a half periphery of the sectional profile thereof.

[0017]

In the illustrated tire, two wire chafers 7 are arranged in the bead portion 2 so as to extend outward from an inner peripheral side portion of the bead core 3 along the carcass ply 1 in the widthwise direction of the tire and arrive at an outer peripheral side exceeding over an outer peripheral edge of a contact zone between an outer surface of the bead portion and a rim flange 6 in the radial direction and also two wire chafers 9 are arranged at an inside of the bead portion 2 in the widthwise direction of the tire and in an inner peripheral zone from an outer end of the bead filler 5 in the radial direction so as to sandwich a main body 8 of the carcass ply 1 therebetween from a thickness direction thereof. Moreover, the wire chafer may be further extended outward from the outer end of the bead filler in the radial direction.

The term "contact zone with the rim flange 6" used herein means a maximum contact zone of the outer surface of the bead portion in the running of the tire under loading.

[0018]

According to the above arrangement of the wire chafers 7, 9, when load is applied to the bead portion 2 in the running of the tire under loading, the wire chafer 7 located outside in the widthwise direction of the tire acts to control the

flowing of rubber in the radial direction/widthwise direction of the tire at the contact zone with the rim flange and the displacement into the equatorial direction of the tire.

Also, the wire chafer 9 located inside in the widthwise direction of the tire acts to control the fall-down of the bead portion outward in the widthwise direction of the tire (i.e. increasing the rigidity).

[0019]

As a result, the lateral rigidity of the bead portion 2 is increased to effectively control the fall-down deformation of the bead portion outward in the widthwise direction of the tire, so that fatigues in the outer surface part of the bead portion contacting with the vicinity of the outer peripheral edge of the rim flange 6 and in a bead heel part contacting with a base part of the rim flange 6 can sufficiently be controlled to largely improve the bead portion durability.

[0020]

When the cords are crossed with each other and extended in opposite directions between the two wire chafers 7 and between the two wire chafers 9, preferably among the wire chafers and the carcass ply 1, the wire chafers are deformed so as to control their movements and hence the effect of controlling the fall-down deformation outward in the widthwise direction of the bead portion is more increased.

[0021]

Moreover, either the wire chafers 7 and 9 shown in Fig. 1 can be omitted. When the wire chafers 7 are omitted, it is favorable that an inner end of the wire chafer 9 located between the main body 8 of the carcass ply 1 and the bead filler 5 in the radial direction is positioned in the vicinity of the bead core 3 and an inner end portion of the other wire chafer 9 in the radial direction is positioned along the inner peripheral side of the bead core 3 and fastened through the bead core 3 as shown in Fig. 2 for enhancing the effect of controlling the fall-down deformation.

[0022]

Fig. 3 is modified embodiments of Fig. 2, wherein the arrangement of the hard rubber stock 5a and soft rubber stock 5b constituting the bead filler 5 is changed while rendering the wind contact part 4 of the carcass ply 1 into an approximately elliptical form. In the embodiment of Fig. 3(a), the other wire chafer 9 as shown in Fig. 2 is turned up through the inner peripheral side of the bead

core 3 upward in the radial direction of the tire at the outside in the widthwise direction thereof.

[0023]

Fig. 3(b) is a further modified embodiment of Fig. 3(a), wherein two additional reinforcing layers 10 made of organic fiber cords such as nylon fiber cords and the like are extended from the inner peripheral side of the bead core 3 upward in the radial direction of the tire at the outside in the widthwise direction thereof so as to hold down the other wire chafer 9 and outer ends of the additional reinforcing layers 10 in the radial direction located at the outside in the widthwise direction are positioned upward from the outer end of the other wire chafer 9 in the radial direction.

[0024]

In the embodiment of Fig. 3(c), the wire chafers 9 are arranged in the same manner as in Fig. 2 and two additional reinforcing layers 10 made of nylon fiber cords are located at outer peripheral sides of the wind contact part 4 of the carcass ply 1 and the other wire chafer 9 and wound around the bead core 3 from the inside of the tire toward the outside thereof in the radial direction.

[0025]

In any case of the above bead portion structures, the separation failure at the wind contact part of the carcass ply 1 is sufficiently prevented, and also the fatigue breakage of the bead portion can advantageously be eliminated to considerably improve the bead portion durability.

[0026]

[Example]

A test for evaluating a bead portion durability on a drum is carried out with respect to Example tires shown in Figs. 3 and 5 and a conventional tire of Fig. 5 to obtain results as shown in Table 1 by an index. Moreover, the larger the index value, the better the result.

[0027]

In this test, a tire to be tested having a tire size of 285/60R22.5 is assembled onto a rim having a rim width of 9.00x22.5 and inflated under an air pressure of 900 kPa and run on the drum under a load of 3150 kgf x 1.5 until separation failure is created in an outer surface part of the bead portion contacting

with a rim flange due to flatting (rubber flowing).

[0028]

[Table 1]

Tire	Example tire 1	Example tire 2	Example tire 3	Example tire 4	Conventional tire
Structure	Fig. 3a	Fig. 3b	Fig. 3c	Fig. 4	Fig. 5
Bead portion durability (index)	175	170	185	160	100

[0029]

As seen from Table 1, all example tires have a considerably improved bead portion durability as compared with the conventional tire because the effect of preventing separation failure at the turnup end of the carcass ply and the effect of preventing the fatigue breakage are improved.

[0030]

[Effect of the Invention]

As mentioned above, according to the invention, there can be provided pneumatic tires having a considerably improved bead portion durability by combining the wind contact part of the radial carcass ply with the steel cord reinforcing layer for the bead portion. Particularly, the invention is suitable for pneumatic radial tires used in heavy duty vehicles such as truck, bus and the like running under higher internal pressure and load.

[Brief Description of the Drawings]

[Fig. 1] is a section view in widthwise direction of tire illustrating a first embodiment of the invention.

[Fig. 2] is a section view in widthwise direction of tire illustrating a second embodiment of the invention.

[Fig. 3] is a section view in widthwise direction of tire illustrating a modified embodiment of Fig. 2.

[Fig. 4] is a section view in widthwise direction of tire illustrating an example tire.

[Fig. 5] is a section view in widthwise direction of tire illustrating the conventional structure.

[Description of Reference Symbols]

1 carcass

- 2 bead portion
- 3 bead core
- 4 wind contact part
- 5 bead filler
- 5a hard rubber portion
- 5b soft rubber portion
- 6 rim flange
- 7, 9 wire chafer
- 8 main portion
- 10 additional reinforcing layer

図1

Fig. 1

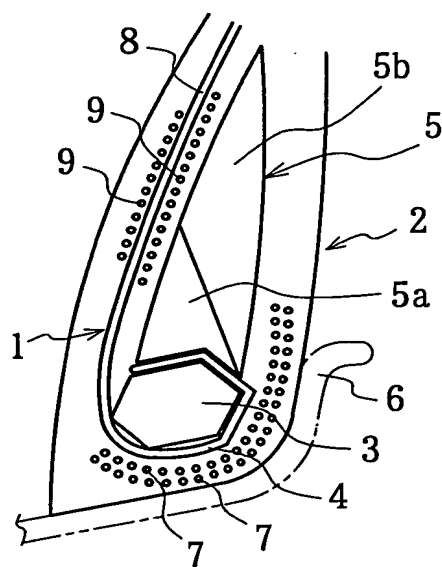
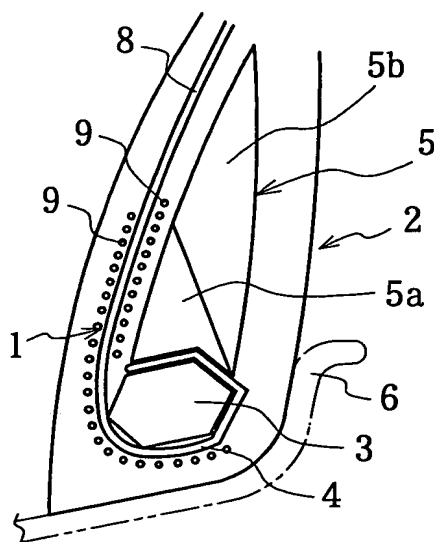


図2
Fig. 2



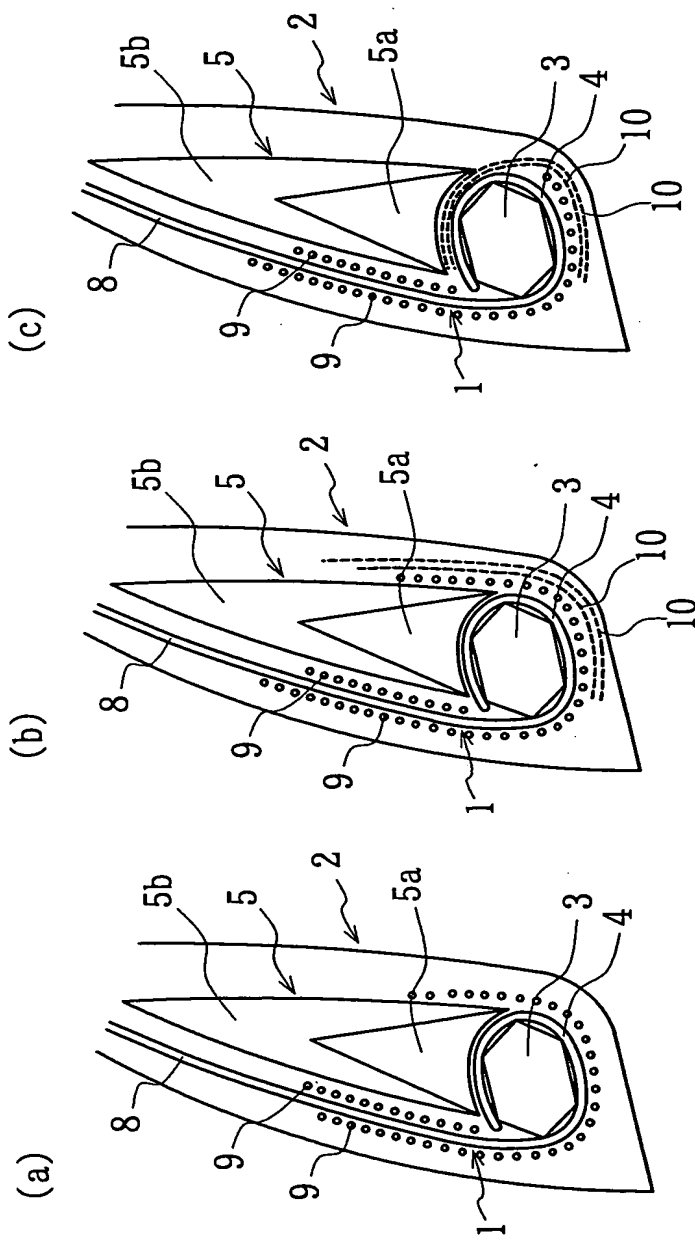


Fig. 3

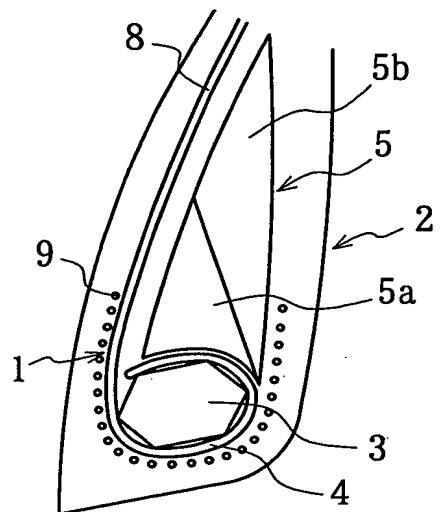


Fig. 4

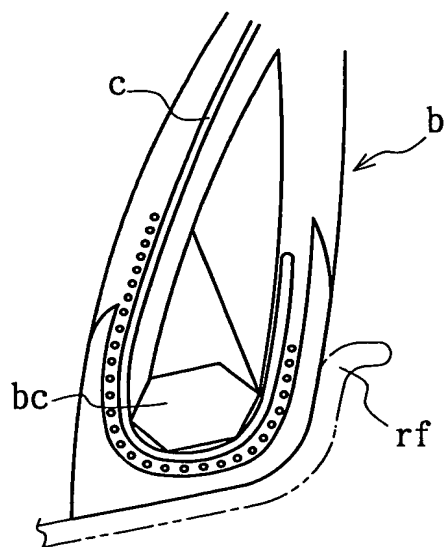


Fig. 5

[Identification of Document] ABSTRACT

[Abstract]

[Object] It is to improve a bead portion durability by preventing the occurrence of separation failure at the wound end of the carcass ply and effectively eliminating the fatigue breakage of the bead portion.

[Means for solution] A carcass ply 1 is toroidally extended from a tread portion through a sidewall portion to a bead portion and wound around a bead core 3 embedded in the bead portion from an inside of the tire toward an outside thereof to form a part or a whole of a wound portion of the carcass ply as a wind contact part 4 along the peripheral face of the bead core 3, wherein one or more wire chafers 7, 8 are arranged in the bead portion 2.

[Selected Figure] Fig. 1